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ABSTRACT

This paper describes the process used to design and evaluate a computer-based tool that guides the development of lesson plans. The tool, PLANalyst, contains a small expert system with a human face that analyzes lessons and gives specific feedback for improvement. The process used to create PLANalyst can be generalized to the development of tools to support any complex intellectual task. PLANalyst runs on Macintosh computers and was constructed with HyperCard. The tool allows easy creation and editing of lessons and provides printed out lesson plans that encourage lessons based on sound instructional principles and realistic estimation of time. It also provides a common language and a tool for team teaching and instructional development. The model on which it is based most closely resembles the nine events of instruction of R. M. Gagne and others. Preparation screens and event screens are illustrated, and the expert system is described. Field tests with close to 200 college students have supported the utility of the tool. The final version, still in development, will incorporate a database of useful teaching techniques drawn from ERIC citations. Six figures illustrate the screens. Two appendixes contain event categories and an evaluation form. (Contains 7 references.) (SLD)

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ED 373 711

Title:

Design and Formative Evaluation of PLANalyst: A Lesson Design Tool

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Introduction

While most graduate programs in educational technology focus on the design of instructional materials in a wide range of media, the most common delivery mode of education and training is still the instructor-led course. Regardless of how much CBT or multimedia experience a designer may have, he or she is often called upon to put together a workshop or presentation quickly. To enable teachers and trainers to draft and edit lesson plans efficiently and to share them with others in a consistent format, a tool called PLANalyst was developed.

This paper describes the process used to design and evaluate a computer-based tool that guides the development of lesson plans. The tool, PLANalyst, contains a small expert system with a human face which analyzes lessons and gives specific feedback for improvement. The process used to create PLANalyst can be generalized to the development of tools to support any complex intellectual task.

PLANalyst runs on Macintosh computers and was constructed with HyperCard. No knowledge of HyperCard is required other than familiarity with the graphical user interface conventions of mouse and menu use.

The Problem

What makes planning a class or workshop or presentation a challenge? What gets in the way of good instruction? Novice instructors tend to try to pack too much information into the time allotted, don't provide enough opportunities for distributed practice and feedback, forget that many learners need to be systematically motivated by having the relevance of the content made clear, neglect to orient the learners to the material and activate their prior knowledge, and stick to a limited number of tried and true teaching strategies. Seasoned instructors do all of these things, too, though less often.

These mistakes can be avoided by devoting enough effort to the planning of a lesson. As with anything else, this kind of planning effort will happen more in the real world if the task can be made easy, efficient, and (dare we hope) enjoyable.

PLANalyst was developed to support the lesson design process. It...

- allows easy creation and editing of lessons: changing times, adding and deleting activities, rearranging the sequence, etc.
- provides clearly printed out lesson plans which show minute by minute how the lesson is to be presented.
- encourages users to base their lessons on sound instructional principles and to realistically estimate their time requirements.
- contains a built-in expert system that can evaluate lesson plan and suggest changes.
- provides a common language and tool for team teaching and instructional development. The work of designing a lesson can be spread out over multiple authors. PLANalyst allows events from separate lesson plans to be merged into one.

- can be used to promote consistency across classes with multiple sections and instructors.

- can be used to observe, record, document and evaluate teaching by principals, teacher educators and training managers.

Steps in Creating an Electronic Performance Support Tool.
The process of designing a tool like PLANalyst follows a path similar to that performance technologists use to develop other problem solutions.

1. Define the problem.
2. Develop solution specifications.
3. Develop the interface
4. Develop the knowledge base.

Across all of these steps is a constant process of user testing and refinement as needed.

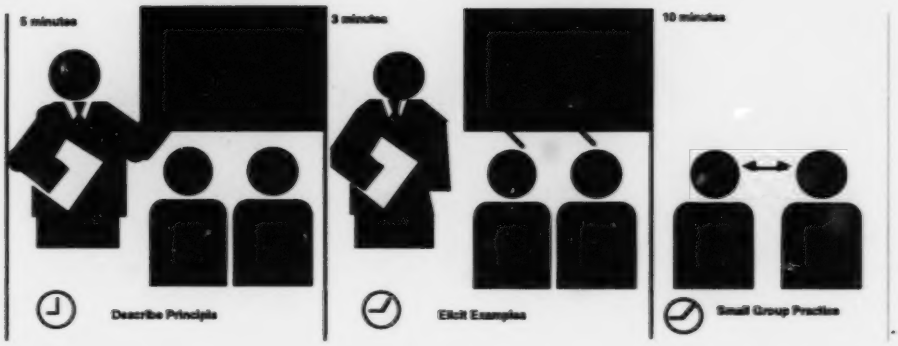
The problem definitio. this case included the assumptions that the target users of the tool...

- are sometimes unsure of the necessary ingredients of a successful lesson
- often forget to include those elements they know to constitute good instruction
- often err in the amount of time allocated to instructional activities
- need to be able to communicate their instructional intentions clearly to others on paper
- see lesson planning as an onerous chore to be done with minimal detail and all in one draft
- would benefit by exposure to teaching strategies they might not normally use

The solution specification included the following characteristics of the tool. The user should be able to...

- generate lesson ideas quickly and refine them later
- rearrange the order of lesson activities easily
- consider time requirements at every point while drafting the lesson.
- create attractive printouts in various forms
- justify the instructional purpose served by every instructor act.
- access specific suggestions for teaching strategies with pointers to published articles and other documents

Design
PLANalyst is built on the assumption that a presentation or lesson can be divided into distinct chunks of one minute or more in duration, and that each chunk should serve some instructional or practical purpose. PLANalyst is intended to be equally useful to experienced and novice presenters or teachers, though meeting this design goal has proven to be a challenge.



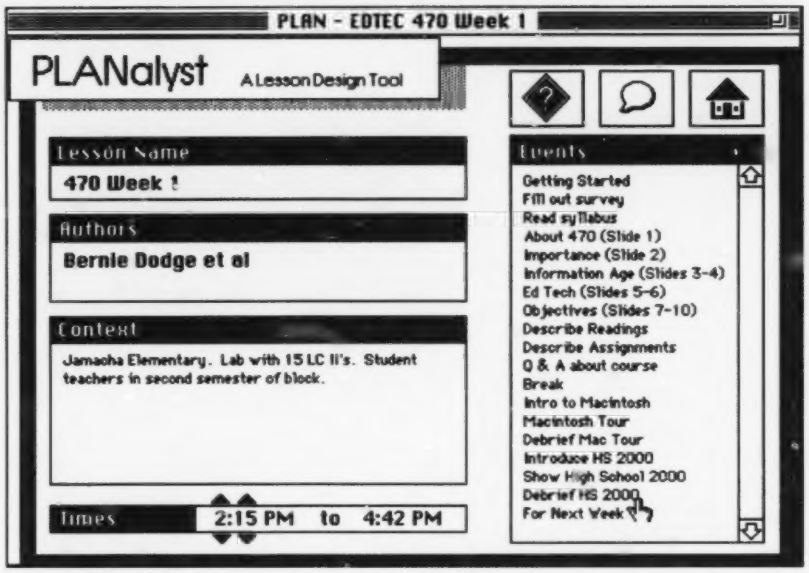
The instructional design model that PLANalyst is based on most closely is that of Gagné's nine events of instruction (Gagné, Briggs & Wager, 1992). That model is most appropriately used for direct instruction ...the teacher-centered, objective-driven approach used most often in the training of adults. Additionally, suggestions summarized from the adult training literature and professional practice by Powers (1992) were incorporated. To widen the applicability of the tool to teachers of children, models of indirect instruction and cooperative learning were added to the rule base. These models were derived from work by Johnson & Johnson (1991), Joyce, Weil & Showers (1992), and Slavin (1983).

In one fundamental way, however, PLANalyst runs contrary to the standard instructional systems design approach: it allows one to begin the process of lesson design by listing possible activities rather than proceeding deductively from objectives. This activities-first approach is in keeping with how teachers conceptualize the lesson planning process (Sherman, Driscoll & Klein, 1994). There is nothing to prevent an instructional designer from using PLANalyst by specifying objectives first and going on to draft learning activities.

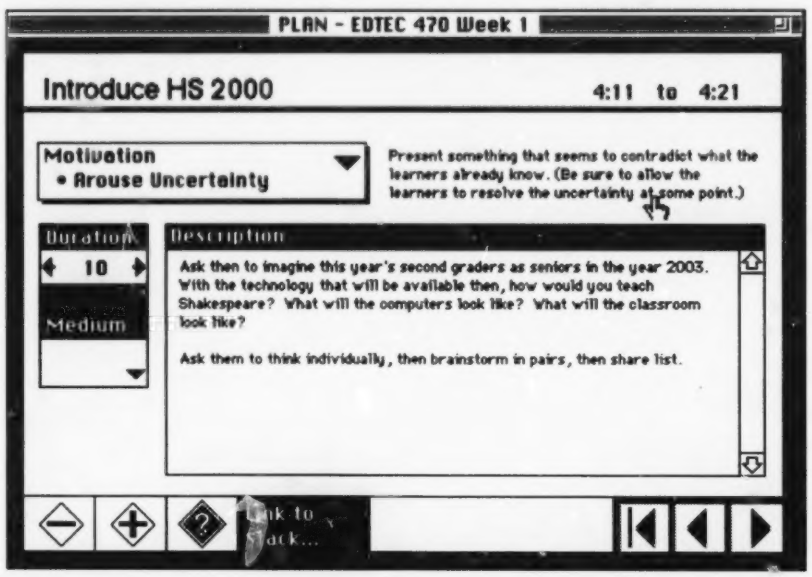
There are three major parts to the PLANalyst tool:

- preparation screens,
- event screens, and
- an expert system.

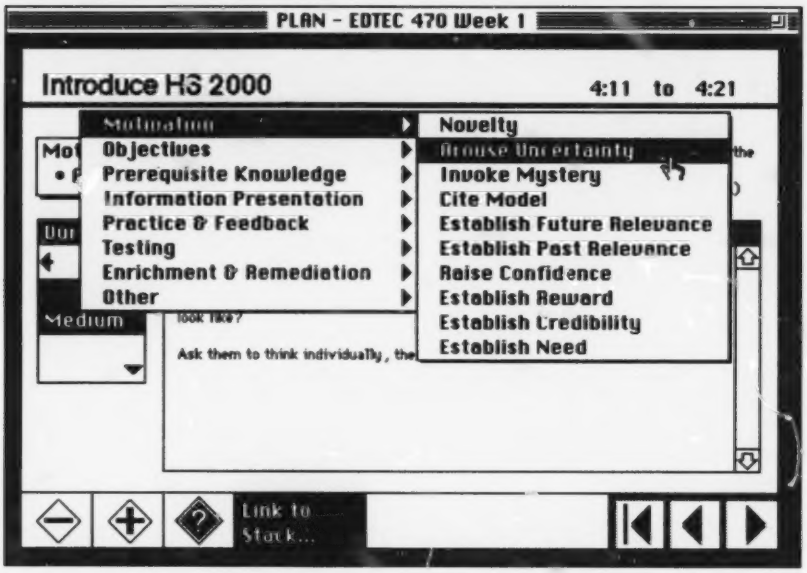
On *Preparation Screens*, the lesson designer describes the learners, the content, the instructional context, and practical considerations such as room arrangements and materials needed. This description can be printed out when the plan is finalized to serve as a reminder before the lesson is delivered. There are three such screens in the present version of PLANalyst. The presence of fields and checkboxes requiring input reminds the user to analyze the learners and subject matter before rushing headlong into design.



To describe each event, the user completes an *Event Screen* like the one below.


PLAN - EDTEC 470 Week 1
Introduce HS 2000
4:11 to 4:21
Motivation
• Arouse Uncertainty
Present something that seems to contradict what the learners already know. (Be sure to allow the learners to resolve the uncertainty at some point.)
Duration
10
Medium
Description
Ask them to imagine this year's second graders as seniors in the year 2003. With the technology that will be available then, how would you teach Shakespeare? What will the computers look like? What will the classroom look like?
Ask them to think individually, then brainstorm in pairs, then share list.

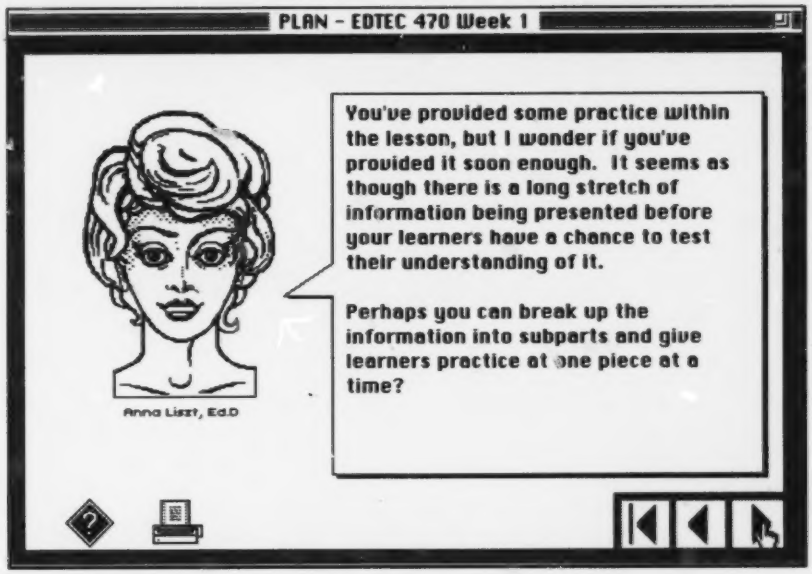
Each event is labeled with a short name (Introduce HS 2000, in this example). A hierarchical pop-up menu allows the user to tag the event with one of close to 70 identifiers which describe the instructional purpose of the event (in this example "Arouse Uncertainty", one of 10 items under the "Motivation" category was chosen.



The user specifies how long the event will take by clicking on arrow buttons and the time span during the which the event will take place is immediately recalculated and displayed at the upper right part of the screen. The largest item on the screen is a scrolling field in which notes on what to do at this point in the lesson can be written. Users can navigate through the lesson by clicking on the arrow buttons in the lower right part of the screen, or by clicking on the "Return to Main Menu" button.

On the Main Menu, the list of all events in the lesson can be seen. One can travel to the screen describing the event by clicking on its name. Events can be re-sequenced by dragging them up or down through the list.

With the *Expert System*, the user can at any point request advice from a modest knowledge base built into PLANalyst. The system scans through the draft lesson plan and looks at the amounts of time spent on specific types of events, the sequencing of those events, and descriptions of the learner group and content. A rule base of twenty principles is consulted which triggers positive comments or corrective feedback as appropriate. The advice is given through the persona of Anna Liszt, who is described as an experienced teacher and instructional designer. This feedback can be viewed on screen or printed out.


PLAN - EDTEC 470 Week 1
You've provided some practice within the lesson, but I wonder if you've provided it soon enough. It seems as though there is a long stretch of information being presented before your learners have a chance to test their understanding of it.
Perhaps you can break up the information into subparts and give learners practice at one piece at a time?
Anna Lisst, Ed.D

Field Testing

PLANalyst has been used by close to two hundred students at San Diego State University during the last two years. About half of those using the tool are pre-service teachers taking a course in educational computing; the others are graduate students in instructional design. At the end of each semester, students rate each element of PLANalyst and suggest improvements.

Routines in the software (Williams & Dodge, 1993) were used to unobtrusively track data on how PLANalyst was used by students. These data include the amount of time spent in each part of the program, the amount and type of editing done, and patterns of use of the expert system.

A typical sample of the tracking data looks like this:

2841218642 SO with PLANalyst version .99c3
2841218648 MBR
2841218813 AS 8:00 AM
2841218819 AE
2841218831 ED Take Roll to 3
2841218878 EW Take Roll . # Words = 9
2841218892 AE
2841218911 ED Importance of Chinese Society to 8

Which translates into this:

Wednesday, January 12, 1994 11:24:02 AM
11:24 Opened stack with PLANalyst version .99c3
11:24 Menu choice: Brainstorm Events
11:26 Adjusted starting time to: 8:00 AM

11:26 Clicked on Events list
11:27 Adjusted duration of Event *Take Roll* to 3 minutes
11:27 Edited Description of Event *Take Roll* . Total # Words = 9
11:28 Clicked on Events list
11:28 Adjust duration of Event *Importance of Chinese Society* to 8 minutes

In the next round of examination of these data now under way, cluster analysis will be used to identify categories of usage patterns, and the completed lesson plans of all participants will be rated qualitatively and related to these clusters.

In the earliest trials of the software, user feedback was collected in the form of open-ended paragraphs summarizing their opinions, as well as informal interviews with users. In the most recent field tests of PLANalyst, a questionnaire was used to get specific feedback on the program (Appendix B). The results of testing the most recent version were as follows: (N=11). To simplify the data for a coarse-grained analysis, Agree and Strongly Agree responses were lumped together, as were Disagree and Strongly Disagree; Neutral responses were left out of the table.

Statement	% Agree	% Disagree
The printouts were legible and attractive	91%	0%
The Rearrange Events feature is useful	91%	9%
The Brainstorming Events feature is useful	91%	9%
PLANalyst was easy to use	91%	0%
PLANalyst will be useful primarily for planning special or unusual events	90%	0%
The time spent putting a lesson into PLANalyst form would be well spent	**54%**	**36%**
The program seemed to run slowly	50%	27%
It was difficult to find an appropriate category to describe an event I wanted to include	**45%**	**36%**
There were enough different print out formats provided	45%	9%
The advice from Anna was useful and appropriate	**36%**	**45%**
I'd use "Lite" mode more often than the Full mode	36%	0%
PLANalyst is too time-consuming to be practical	36%	45%
In general, a lesson should fit on one page	36%	36%
PLANalyst will be useful for everyday planning	**36%**	**36%**
The program was cumbersome	20%	70%
The type on the printouts was too small	9%	81%
The printouts took up too much paper	9%	63%

The results in the table above break down cleanly into three categories: at the top, desirable statements that most users agreed with; at the bottom, undesirable statements that users tended to disagree with, and the middle ground where targets of improvement can be identified. The statements shown in bold seem the most important to work on, and the next round of software refinement will focus on raising the ratings here. In practice, this means adding more categories for describing instructional events and adding rules to Anna's rulebase to smarten her advice.

One major step in this regard is the addition of a database of teaching strategies. Over 600 ERIC citations have been identified as containing information on useful teaching techniques. In the final release version of PLANalyst, users will be able to access this database and print out strategies and citations appropriate to their present lesson. It is hoped that the database will be rich enough that even experienced teachers and trainers will be shown strategies that they would not have thought of, thus raising the perceived usefulness of Anna's advice and the global value of the tool.

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Gagne, R. M., Briggs, L. J., & Wager, W. W. (1992). *Principles of instructional design* (Fourth edition). Orlando, FL: Harcourt Brace Jovanovich.

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Software Availability

PLANalyst will be published in late March, 1994 by SuperSchool Software, 1857 Josie Avenue, Long Beach CA 90815. Telephone: 800/594-8580.

Appendix A: Instructional Event Categories

Prior Knowledge Activation
Review Previous Learning
Use Analogy
Ask Review Questions
Pre-Test

Information Preview
State Objectives Formally
State Objectives Informally
Show Final Goal
Provide Overview
Provide Background
Teacher Pre-Questions
Learner Pre-Questions
Advance Organizer

Motivation
Novelty
Arouse Uncertainty
Evoke Mystery
Cite Model
Establish Future Relevance
Establish Relevance to Past
Raise Confidence
Establish Reward
Establish Credibility
Establish Need

Information Acquisition
Give Definition
Examples/Non-examples
Definitions & Examples
Procedure Description
Procedure Demonstration
Fact Presentation
Problem Definition
Discussion
Socratic Dialog
Analogies
Anecdotes
Inquiry - Individual
Inquiry - Group
Peer Tutoring
Teacher Mnemonic
Learner Mnemonics

Practice & Feedback
Individual Practice (Guided)
Group Practice (Guided)
Individual Practice (Independent)
Group Practice (Independent)
Group Feedback
Peer Feedback
Delayed Feedback
Simulation
Drill
Brainstorming
Role Play
Q & A
Debriefing

Closure
Reflection
Student Self-Test
Post-Test
Teacher Summary
Learner Summary

Other
Administration
Assign Roles or Tasks
Ice Breaker
Social
Break
Rearrange Classroom
Planning Time
Session Evaluation
Other (Instructional)
Other (Non-Instructional)

Appendix B: PLANalyst Evaluation Form

Your Name (optional) _____

Years of teaching experience ? _____ Subject/Grade level? _____

Thanks for giving PLANalyst a try. Your opinions about PLANalyst are very valuable to me as I refine its features in preparation for publication. Please give your thoughtful, frank and honest responses to the questions on this page. --- Bernie Dodge

For each statement, please circle the response that corresponds most closely with your opinion.

SD = Strongly Disagree, D = Disagree, N = Neutral, A = Agree, SA = Strongly Agree

PLANalyst will be useful for everyday lesson planning.	SD	D	N	A	SA
PLANalyst will be useful primarily for planning special or unusual lessons.	SD	D	N	A	SA
The Rearrange Events feature is useful	SD	D	N	A	SA
The Brainstorming feature is useful.	SD	D	N	A	SA
The program seemed to run slowly.	SD	D	N	A	SA
PLANalyst was easy to use.	SD	D	N	A	SA
The program was cumbersome.	SD	D	N	A	SA
It was difficult to find an appropriate category to describe an event I wanted to include.	SD	D	N	A	SA
The advice from Anna was useful and appropriate.	SD	D	N	A	SA
I'd use the "Lite" mode more often than the "Full" mode.	SD	D	N	A	SA
PLANalyst is too time-consuming to be practical.	SD	D	N	A	SA
There were enough different print out formats provided.	SD	D	N	A	SA
The printouts were legible and attractive.	SD	D	N	A	SA
The printouts took up too much paper.	SD	D	N	A	SA
In general, a lesson plan should fit on one page.	SD	D	N	A	SA
The type on the printouts was too small.	SD	D	N	A	SA
The time spent putting a lesson into PLANalyst form would be well spent.	SD	D	N	A	SA

Can you think of any categories of event types that should be added to the pop-up list? If so, please describe them.

Can you think of other features you'd like to see added?

Did you experience any 'bugs' or flaky program behavior? If so, please describe.

If you had to summarize your opinion of PLANalyst in just a few sentences, what would you say?